

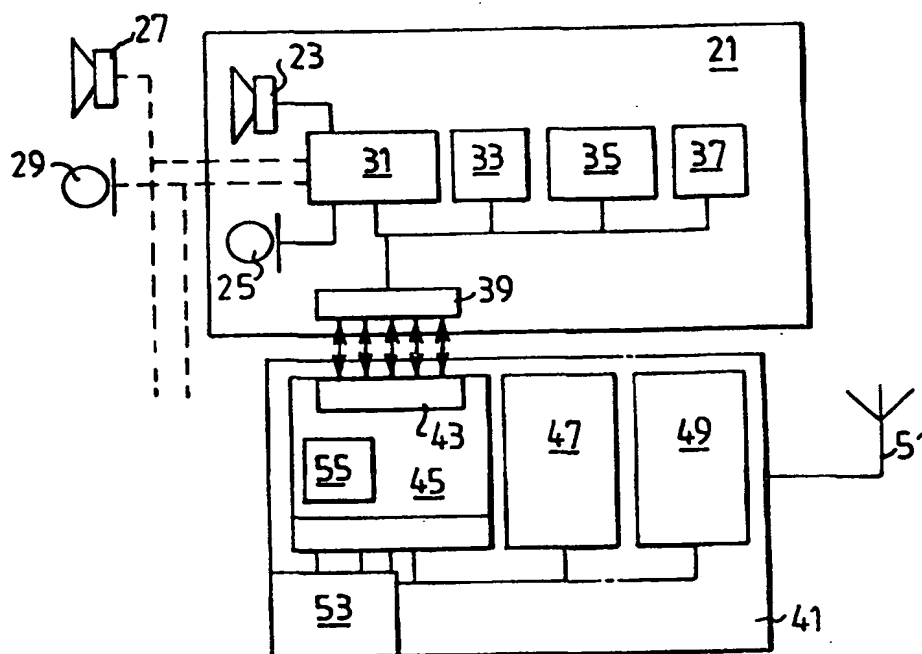


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>6</sup>:</b> <b>H04M 1/00, 1/60</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 99/45685</b> <b>(43) International Publication Date:</b> 10 September 1999 (10.09.99)
<b>(21) International Application Number:</b> PCT/SE99/00268 <b>(22) International Filing Date:</b> 25 February 1999 (25.02.99)  <b>(30) Priority Data:</b> 9800697-6      5 March 1998 (05.03.98)      SE  <b>(71) Applicant:</b> TELEFONAKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S-126 25 Stockholm (SE).  <b>(72) Inventor:</b> OHLGREN, Håkan; Klena vägen 23, S-136 69 Haninge (SE).  <b>(74) Agents:</b> BERG, S., A. et al.; Albihns Patentbyrå Stockholm AB, P.O. Box 5581, S-114 85 Stockholm (SE).		<b>(81) Designated States:</b> AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.          Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

**(54) Title:** AUDIO DEVICE SELECTOR FOR WIRELESS COMMUNICATION**(57) Abstract**

An audio path selecting means for wireless communication is adapted to function with a portable terminal to which more than one audio device may be connected, for example including one or more hands-free sets connected by a wired or a wireless connection, a loudspeaker and/or a microphone found in the portable device and an external loudspeaker and/or microphone connected to the portable device or the communication card. The audio path selection means receives information about available audio devices and determines which one of the audio devices should be used for sound input/output, preferably according to a priority list found in the audio path selecting means. The audio path selecting means may also be adapted to act on manual instructions that override the priority list. The audio path selecting means may be implemented on a PCMCIA card or in a terminal that is adapted to wireless communication.



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## AUDIO DEVICE SELECTOR FOR WIRELESS COMMUNICATION

**Technical Field**

The present invention relates to wireless communication, and in particular to the transmission and reception of sound in wireless terminals.

**Description of Related Art**

There is a constant demand for portable devices for wireless communication to become smaller and lighter and at the same time have increased functionality. The Personal Computer Memory Card International Association (PCMCIA) has developed a card, the PCMCIA card, with a standardized interface. A PCMCIA card is approximately 55 mm wide and 85 mm long, and may be either 3.3 mm, 5 mm or 10.5 mm thick. The pin socket is standardized and includes 68 pins.

The PCMCIA card can be used, among other things, for wireless communication. Applications have been developed providing all functions required for wireless communication. The wireless communication card based on the PCMCIA card is normally inserted into some kind of portable terminal, such as a laptop PC, and can then function as a mobile telephone, a wireless modem and a fax. It may also be combined, for example, with a unit providing a keypad and a hands-free set to function as a mobile telephone.

Different types of audio equipment may be connected to the wireless communication card, and to the device in which it is inserted.

**Summary of the Invention**

It is an object of the present invention to enable the use of several different types of audio equipment in a device adapted to wireless communication, such as a personal computer, and to switch between them in a way that is perceived as simple by the user,

These objects are achieved according to the present invention by an audio path selecting means for wireless communication, adapted to function with a portable terminal to which more than one audio device may be connected,

- 5    said audio path selection means being adapted to
- receive information about available audio devices,
  - determine which one of the available audio devices should be used for sound input/output.

- 10   The audio device to be used is determined according to a priority list preferably found in the audio path selecting means. The audio path selecting means may also be adapted to act on manual instructions that override the priority list.

- 15   A communication card, such as a PCMCIA card, for wireless communication adapted to function with a portable terminal comprises an audio path selecting means is also disclosed

- 20   A portable terminal adapted for wireless communication, to which more than one audio device may be connected, either directly or through a communication card, comprising
- means for registering the audio devices connected, and
  - means for informing an audio path selecting means about the audio devices connected.

- 25   The portable terminal may also comprise an audio path selection means as describes above.

- 30   The audio devices may include one or more hands-free set connected either to the portable terminal or to the communication card by a wired or a wireless connection, a loudspeaker and/or a microphone found in the portable device and an external

loudspeaker and/or microphone connected to the portable device or the communication card.

The invention offers the following advantages:

- 5 It enables the automatic switching to the best available audio device at any time, while still giving the user the opportunity to determine manually what audio device should be used.

### **Brief Description of the Drawings**

- 10 Figure 1 shows a personal computer (PC) with a PCMCIA card according to the invention inserted.

Figure 2 is a block diagram of the PC and the PCMCIA card shown in Figure 1.

Figure 3 is a block diagram of a PC comprising the audio path selecting means.

- 15 Figure 4 is a block diagram of an audio device connected by an infrared (IR) connection.

Figure 5 is a block diagram of an audio device connected by a radio frequency (RF) connection.

Figure 6 is a block diagram of an audio device connected by a wired connection.

Figure 7 is a flow chart of the actions taken when selecting an audio device.

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### **Detailed Description of Embodiments**

- Figure 1 shows a portable PC 1 including a built-in loudspeaker 3 and microphone 5. A PCMCIA card 7 is inserted in an appropriate slot 9 in the PC 1. To the PCMCIA card, two portable hands-free sets 11, 13 are connected: one 11 by a wired connection and the other 13 by a wireless connection, which may be infrared or radio frequency.
- 25

- Other audio equipment, for example an external loudspeaker and an external microphone, or a portable hands-free, may also be connected to the PC or to the PCMCIA card. This is not shown in Figure 1.
- 30

Since several types of audio equipment may be connected at the same time, there must be a way of determining to what audio equipment the sound should be routed.

5 Figure 2 shows an apparatus according to the invention for determining the audio equipment that should be used for transmitting and receiving sound. As before, there is a PC 21 having built-in loudspeaker 23 and microphone 25. An external loudspeaker 27 and an external microphone 29 are also connected in this example. As in Figure 1, other types of audio devices may be connected as well. The loudspeakers  
10 23, 27 and microphones 25, 29 are connected to a sound card 31 in the PC in a way well known in the art. The PC also comprises an input/output unit 33, a memory unit 35 and a central processing unit (CPU) 37. The CPU 37 is connected to a PC card controller 39 for receiving a PCMCIA card 41. The connections between the units are dependent on the type of PC. In this example, the sound card 31, the I/O  
15 unit 33, the memory unit 35 and the CPU 37 are all connected to the same bus.

The PCMCIA card 41 is inserted in the appropriate slot in the PC 21 and the connection is established in a standardized way through the PC card controller 39 in the PC 21 and a PC card interface 43 in the PCMCIA card.

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On the PCMCIA card, the PC card interface 43 is connected to a microprocessor 45 the function of which will be discussed in more detail below. At least one control unit 47 handles memory control, input/output and power control functions.

25

A radio unit 49 and an antenna 51 in the PCMCIA card are used for the wireless communication with, for example, a cellular network (not shown). An audio block 53 is used, among other things, for registering audio equipment that is connected to the PCMCIA card. The radio unit 49, the control unit 47, the audio block 53 and the microprocessor 45 are connected by a common bus.

30

The audio block 53 receives connections from audio equipment such as portable hands-free equipment (not shown). The audio block 53, and the sound card 31, register what audio equipment is connected to the PCMCIA card 41 and the PC 21, respectively and reports this to the microprocessor 45 in the PC card 41. Between the  
5 audio block 53 and the microprocessor 45 there may be one connection for each audio device connector or only one connection through which information is transmitted serially. An audio path selection unit 55 in the microprocessor 45 then determines, on the basis of an algorithm described below, what sound equipment should be used. In a preferred embodiment, the audio path selection unit 55 com-  
10 prises a priority list specifying the priority order of the possible types of audio devices. The audio path selection unit 55 preferably also comprises functions for receiving manual instructions to override the order of the priority list.

The sound equipment may be connected to the PC 1, 21 or the PCMCIA card 7, 41  
15 in any way known in the art. Some known ways are shown in Figures 4-6 and will be discussed in connection with these figures.

Of course, the functions of the audio path selection unit as described above may as well be implemented in the portable device itself. It is not dependent on the  
20 PCMCIA card or any other type of wireless communication card being inserted if the portable device itself contains such functions.

Figure 3 shows a solution according to the invention implemented in a portable terminal that itself comprises functions for wireless communication, for example  
25 with a cellular network.

As before, there is a PC 61 having built-in loudspeaker 63 and microphone 65. There is also an external loudspeaker 67 and an external microphone 69. The loudspeakers 63, 67 and microphones 65, 69 are connected to a sound card 71 in the PC  
30 in a way well known in the art. The PC also comprises an input/output unit 73. a

memory unit 75 and a central processing unit (CPU) 77. The sound card 71, the I/O unit 73, the memory unit 75 and the CPU 77 are all connected to the same bus, which is also connected to a microprocessor 79 handling the audio functions. As in Figure 2, the actual connections between the units depend on the PC architecture.

In this case, the portable device 61 also comprises an antenna 81 and a radio receiving/transmitting unit 83 for communication with a wireless network (not shown). At least one control unit 85 handles memory control, input/output and power control functions.

The audio block 87 also receives connections from audio equipment such as portable hands-free equipment (not shown). The audio block 87, and the sound card 71, register what audio equipment is connected to the PC 61 and reports this to the microprocessor 79. Between the audio block 87 and the microprocessor 79 there may be one connection for each audio device connector or only one connection through which information is transmitted serially. An audio path selection unit 89 in the microprocessor 79 then determines, on the basis of an algorithm described below, what sound equipment should be used. In a preferred embodiment, the audio path selection unit 89 comprises a priority list specifying the priority order of the possible types of audio devices. The audio path selection unit 89 preferably also comprises functions for receiving manual instructions to override the order of the priority list.

In this embodiment, of course, the functions handled by the control unit 85 may instead be integrated with other units in the PC performing similar functions. The microprocessor 79 may, for example, be integrated with the CPU 77 and the audio block 87 may, for example, be integrated with the sound card 71.

Figure 4 shows a possible connection of a wireless audio device 101 connected through an infrared (IR) interface 103. The wireless audio device comprises an earphone 105 (or another loudspeaking device) and a microphone 107, an IR modula-



tor/demodulator 109 and IR diodes 111 for transmission and detection of IR signals. The functions of the IR modulator/demodulator and the IR diodes are well known in the art. The wireless audio device 101 is connected to an input part 113 of, for example, a PCMCIA card or to a PC (not shown in full). This input part 113 comprises IR diodes 115 and an IR modulator/demodulator 117, the functions of which are well known in the art. The IR modulator/demodulator 117 also comprises functions for registering if a device 101 is connected through the IR interface 103 and reporting this to an audio path selecting means 53, 79 as shown in Figures 2 and 3, respectively. This may be reported, for example, as a logical signal, which may be asserted when a device is connected and deasserted when no device is connected.

Figure 5 shows a possible connection of a wireless audio device 121 connected through a radio frequency (RF) interface 123. The wireless audio device comprises an earphone 125 (or another loudspeaking device) and a microphone 127, an RF modulator/demodulator 129 and an RF antenna 131. The functions of the RF modulator/demodulator and the RF antenna are well known in the art. The wireless audio device 121 is connected to an input part 133 of, for example, a PCMCIA card or to a PC (not shown in full). This input part 133 comprises an RF antenna 135 and an RF modulator/demodulator 137, the functions of which are well known in the art. The RF modulator/demodulator 137 also comprises functions for registering if a device 121 is connected through the RF interface 123 and reporting this to an audio path selecting means 53, 79 as shown in Figures 2 and 3, respectively. This may be reported, for example, as a logical signal, which may be asserted when a device is connected and deasserted when no device is connected.

Figures 6A and 6B illustrate a simple solution for registering if a device is connected by a wired connection. Figure 6A shows the situation in which the device is not connected, and Figure 6B shows the situation in which the device is plugged in. A device (not shown), which may be an external loudspeaker and/or a microphone, or a hands-free set, is connected to an inlet part 141 of a portable device, such as a

PC or a PCMCIA card, by means of a connector plug 143. The inlet part 141 comprises connector pins 145 for the transfer of the audio signal, and also comprises a sensor pin 147 for registering whether or not a device is connected. If the device is connected, the plug will press the sensor pin 147 towards a signal wire 149 causing  
5 a logical signal to be transmitted to the audio path selecting means 53, 79 as shown in Figures 2 and 3, respectively.

Figure 7 is a flow chart of the actions taken in the audio path selecting means to determine which audio device should be used at any given time. The audio path selecting means receives information from each inlet terminal to which an audio device  
10 may be connected about whether or not an audio device is actually connected. This information may be transferred at regular intervals or whenever the situation changes, that is, when a device is connected or disconnected. In the flow chart it has been assume that three different audio devices may be connected. Of course, an  
15 arbitrary number of audio devices may be connected. The flow chart would comprise one decision box for each possible audio device.

Step S1: Has a manual command been issued? If yes, go to step S2; if no, go to step S3.

20 Step S2: Connect the audio device manually selected. End of selection procedure.

Step S3: Is the first audio device on the priority list connected? If yes, go to step S4; if no, go to step S5.

Step S4: Connect the first priority audio device. End of selection procedure.

25 Step S5: Is the second audio device on the priority list connected? If yes, go to step S6; if no, go to step S7.

Step S6: Connect the second priority audio device. End of selection procedure.

Step S7: Is the third audio device on the priority list connected? If yes, go to step S8; if no, go to step S9.

Step S8: Connect the third priority audio device. End of selection procedure.

30 Step S9: Disable the use of audio signals. End of selection procedure.

## Claims

1. An audio path selecting means for wireless communication, adapted to function with a portable terminal to which more than one audio device may be connected,  
5 **characterized** in that it is adapted to

- receive information about available audio devices,
- determine which one of the available audio devices should be used for sound input/output.

10 2. An audio path selecting means according to claim 1, **characterized** in that it determines which audio device is to be used according to a priority list.

3. An audio path selecting means according to claim 1 or 2, **characterized** in that it is adapted to act on manual instructions that override the priority list.

15 4. An audio path selecting means according to claim 1, 2 or 3, **characterized** in that it is adapted to act on manual instructions during an ongoing call.

20 5. A communication card for wireless communication adapted to function with a portable terminal, **characterized** in that it comprises an audio path selecting means according to any one of the claims 1-4.

25 6. A communication card according to claim 5, **characterized** in that at least one of the audio devices may be a hands-free set connected either to the portable terminal or to the communication card.

7. A communication card according to claim 5 or 6, **characterized** in that at least one of the audio devices may be a loudspeaker and/or a microphone found in the portable device.

8. A communication card according to any one of the claims 5-7, characterized in that at least one of the audio devices may be an external loudspeaker and/or microphone connected to the portable device or the communication card.

5 9. A communication card according to any one of the claims 5-8, characterized in that it is adapted to register an audio device being connected by a wired connection by means of a sensing pin located in the connector and informing the audio path selecting means by means of a logical signal.

10 10. A communication card according to any one of the claims 5-9, characterized in that it comprises means for registering an audio device being connected by a wireless connection and informing the audio path selecting means by means of a logical signal.

15 11. A portable terminal adapted for wireless communication, to which more than one audio device may be connected, either directly or through a communication card, characterized in that it comprises

- means for registering the audio devices connected, and
- means for informing an audio path selecting means about the audio devices connected.

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12. A portable terminal according to claim 11, characterized in that at least one of the audio devices may be a hands-free set connected either to the portable terminal or to the communication card.

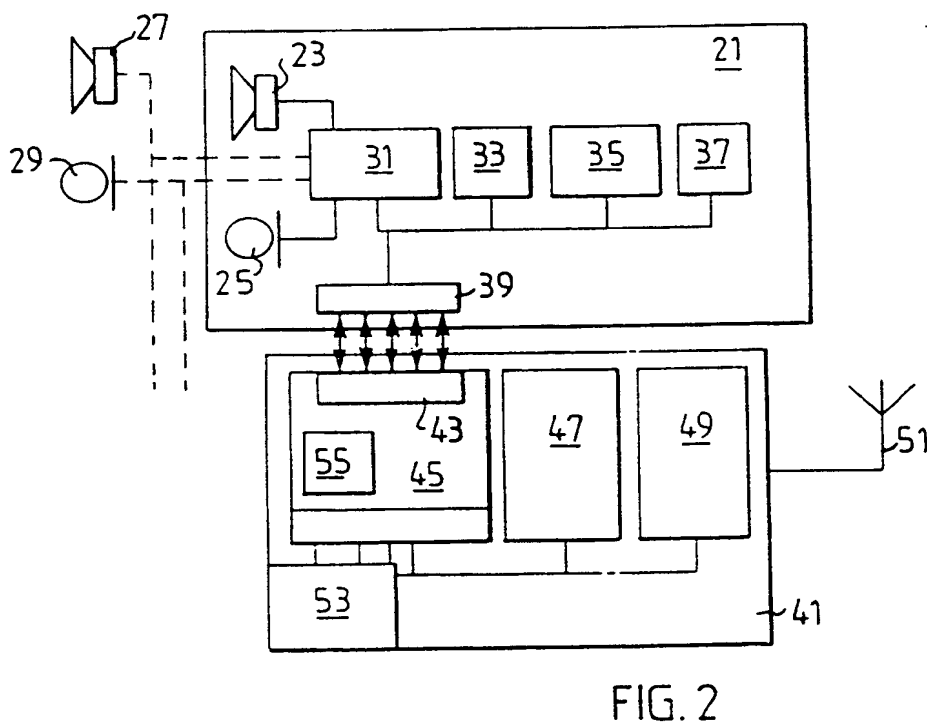
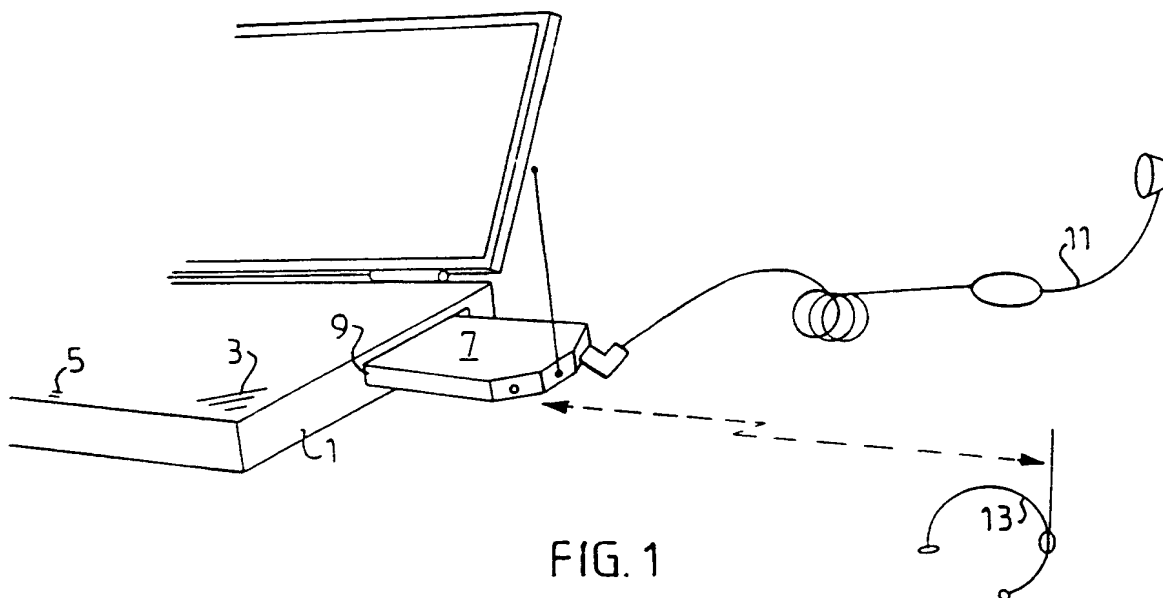
25 13. A portable terminal according to claim 11 or 12, characterized in that at least one of the audio devices may be a loudspeaker and/or a microphone found in the portable device.

14. A portable terminal according to any one of the claims 11-13, **characterized** in that at least one of the audio devices may be an external loudspeaker and/or microphone connected to the portable device or the communication card.

5      15. A portable terminal according to any one of the claims 11-14, **characterized** in that it is adapted to register an audio device being connected by a wired connection by means of a sensing pin located in the connector and informing the audio path selecting means by means of a logical signal.

10      16. A portable terminal according to any one of the claims 11-15, **characterized** in that it comprises means for registering an audio device being connected by a wireless connection and informing the audio path selecting means by means of a logical signal.

15      17. A portable terminal adapted to wireless communication, **characterized** in that it comprises an audio path selecting means according to any one of claims 1-4.



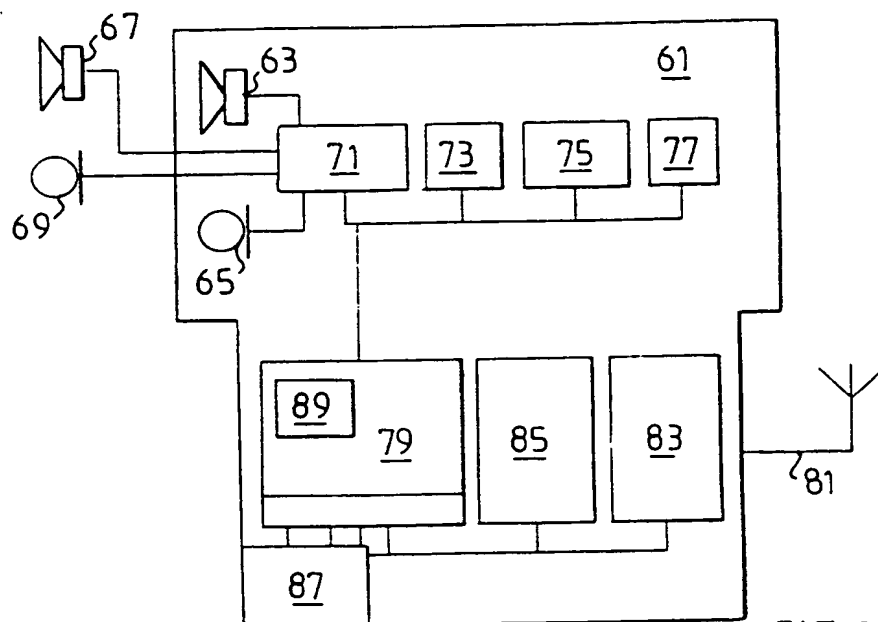


FIG. 3

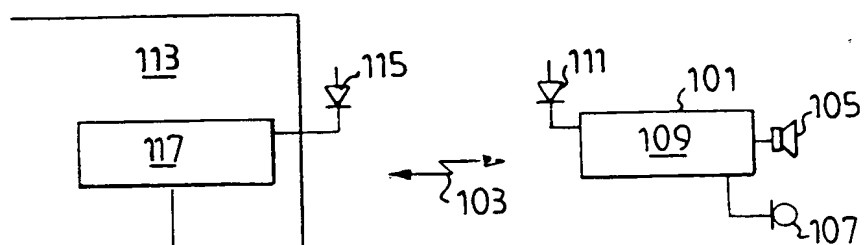


FIG. 4

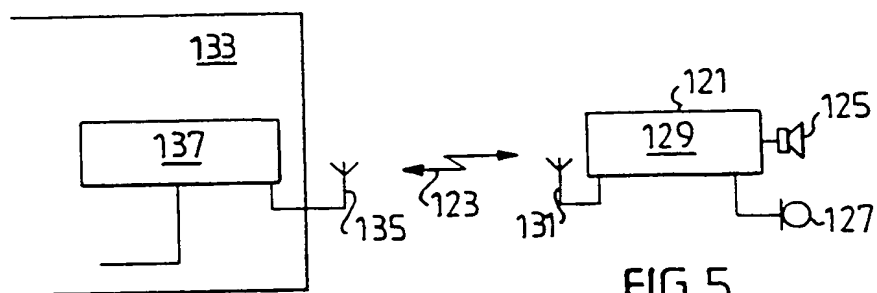
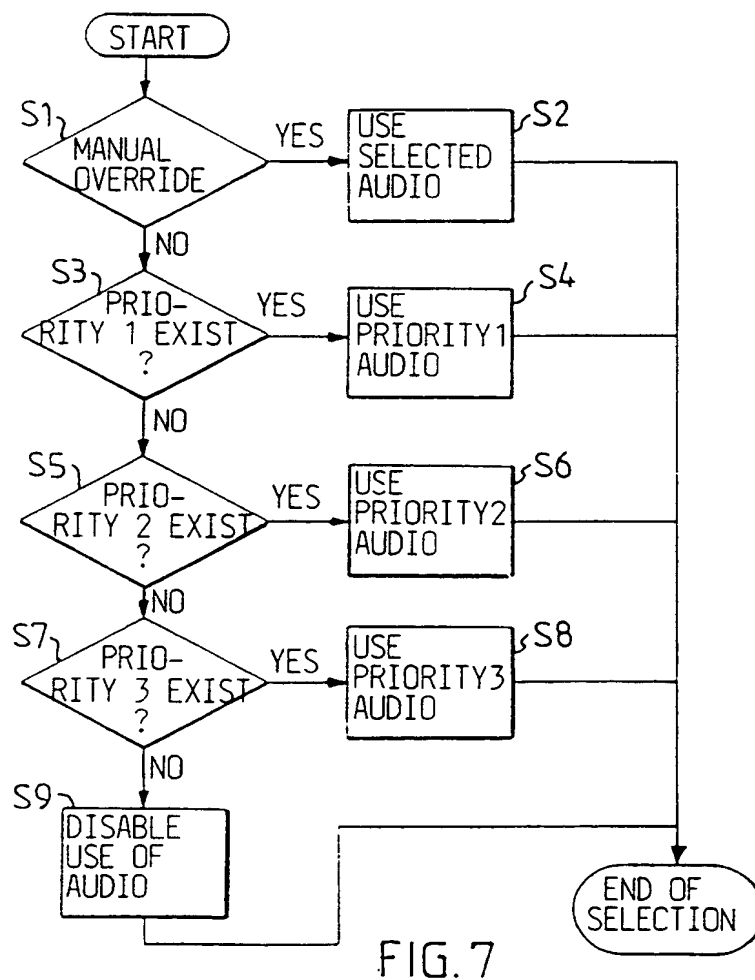
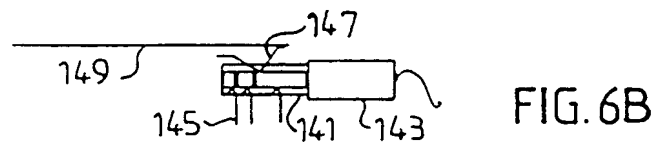
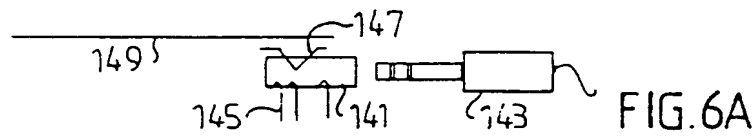


FIG. 5





# INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/00268

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04M 1/00, H04M 1/60

According to International Patent Classification (IPC) or to both national classification and IPC

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Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04B, H04M, H04Q

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 547572 A (TSUTOMU SATO), 12 December 1995 (12.12.95), column 4, line 20 - column 6, line 57, figures 4-5, abstract --	1-17
A	WO 9528051 A1 (JABRA CORPORATION), 19 October 1995 (19.10.95), abstract --	1-17
A	US 4876712 A (GARY T. BRINT ET AL), 24 October 1989 (24.10.89), figures 1-6, abstract -- -----	1-17

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☒ See patent family annex.

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Information on patent family members

01/07/99

International application No.

PCT/SE 99/00268

Patent document cited in search report			Publication date	Patent family member(s)	Publication date
US	547572	A	12/12/95	NONE	
WO	9528051	A1	19/10/95	EP 0754384 A GB 9406872 D JP 10500813 T	22/01/97 00/00/00 20/01/98
US	4876712	A	24/10/89	NONE	

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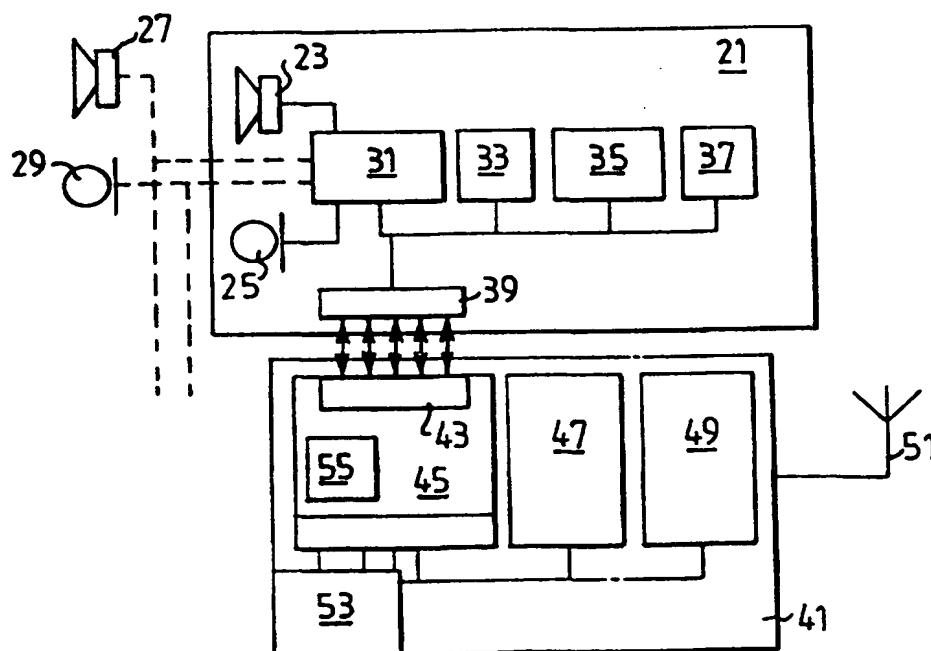
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(51) International Patent Classification <sup>6</sup> : <b>H04M 1/00, 1/60</b>	<b>A1</b>	(11) International Publication Number: <b>WO 99/45685</b> (43) International Publication Date: 10 September 1999 (10.09.99)
(21) International Application Number: PCT/SE99/00268 (22) International Filing Date: 25 February 1999 (25.02.99) (30) Priority Data: 9800697-6                      5 March 1998 (05.03.98)                      SE (71) Applicant: TELEFONAKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S-126 25 Stockholm (SE). (72) Inventor: OHLGREN, Håkan; Klena vägen 23, S-136 69 Haninge (SE). (74) Agents: BERG, S., A. et al.; Albihns Patentbyrå Stockholm AB, P.O. Box 5581, S-114 85 Stockholm (SE).	(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With a revised version of the international search report.</i>  (88) Date of publication of the revised version of the international search report: 3 February 2000 (03.02.00)	

(54) Title: AUDIO DEVICE SELECTOR FOR WIRELESS COMMUNICATION

## (57) Abstract

An audio path selecting means for wireless communication is adapted to function with a portable terminal to which more than one audio device may be connected, for example including one or more hands-free sets connected by a wired or a wireless connection, a loudspeaker and/or a microphone found in the portable device and an external loudspeaker and/or microphone connected to the portable device or the communication card. The audio path selection means receives information about available audio devices and determines which one of the audio devices should be used for sound input/output, preferably according to a priority list found in the audio path selecting means. The audio path selecting means may also be adapted to act on manual instructions that override the priority list. The audio path selecting means may be implemented on a PCMCIA card or in a terminal that is adapted to wireless communication.



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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/00268

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04M 1/00, H04M 1/60

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04B, H04M, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5475872 A (TSUTOMU SATO), 12 December 1995 (12.12.95), column 4, line 20 - column 6, line 57, figures 4-5, abstract --	1-17
A	WO 9528051 A1 (JABRA CORPORATION), 19 October 1995 (19.10.95), abstract --	1-17
A	US 4876712 A (GARY T. BRINT ET AL), 24 October 1989 (24.10.89), figures 1-6, abstract -- -----	1-17

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

02/11/99

International application No.

PCT/SE 99/00268

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5475872 A	12/12/95	EP 0606996 A JP 6216978 A	20/07/94 05/08/94
WO 9528051 A1	19/10/95	EP 0754384 A GB 9406872 D JP 10500813 T	22/01/97 00/00/00 20/01/98
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